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Chen

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(54) **ANTI-THEFT ELECTRONIC SEAL**

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E05B 73/00	(2006.01)
E05B 39/00	(2006.01)

(52) **U.S. Cl.**

CPC ***G08B 13/2448*** (2013.01); ***E05B 39/00*** (2013.01); ***E05B 73/0017*** (2013.01); ***G08B 13/2417*** (2013.01); ***G08B 13/2474*** (2013.01)

(58) **Field of Classification Search**

CPC G08B 13/2448; G08B 13/2474; G08B 13/2417; E05B 73/0017; E05B 39/00; E05B 73/00

USPC 343/720

See application file for complete search history.

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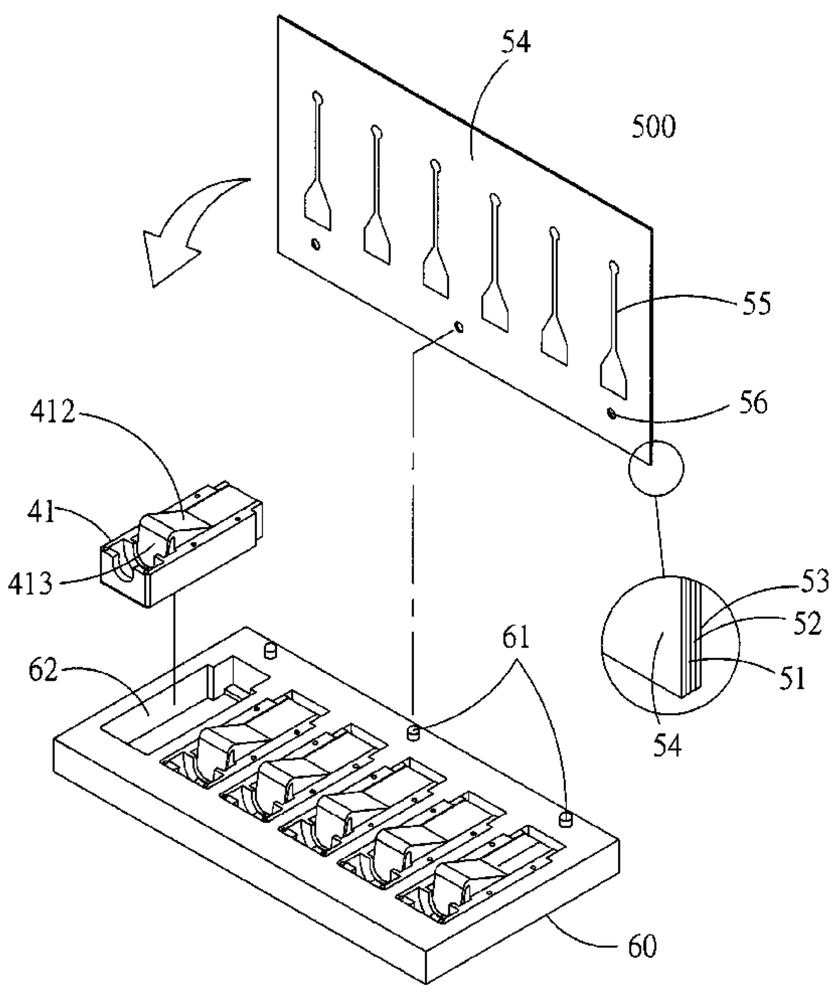
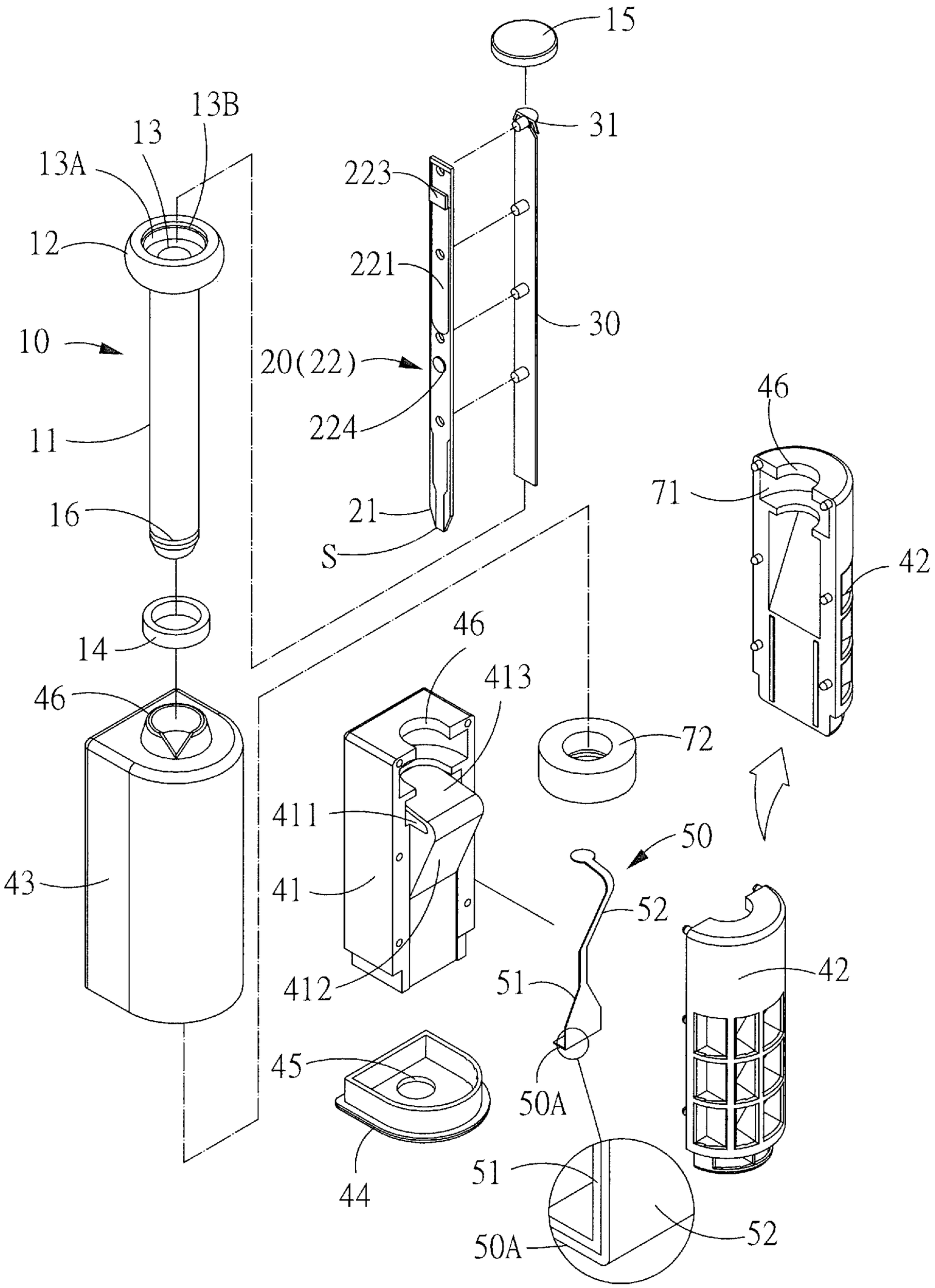
(57) **ABSTRACT**

A bolt includes a conductor having an accommodation hole and a circuit board installed in the accommodation hole, where the upper part of the conductor is covered with an insulating sleeve, and the lower part thereof is configured with a first engagement portion, a RFID chip and lower contact of the circuit board is formed into a control circuit, and the lower contact is allowed to be protruded out of the bottom end of the accommodation hole. An antenna and elastic sheet are configured inside the bolt seat, and the outer peripheral thereof is configured with an insertion hole and second engagement portion adapted to position the first engagement portion, the elastic sheet have a pre-pressure to allow the antenna, control circuit and conductor to be in electric connection with one another. Whereby, the electric connection can be interrupted when the bolt is cut.

13 Claims, 10 Drawing Sheets

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50A
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50A
52

Fig.1

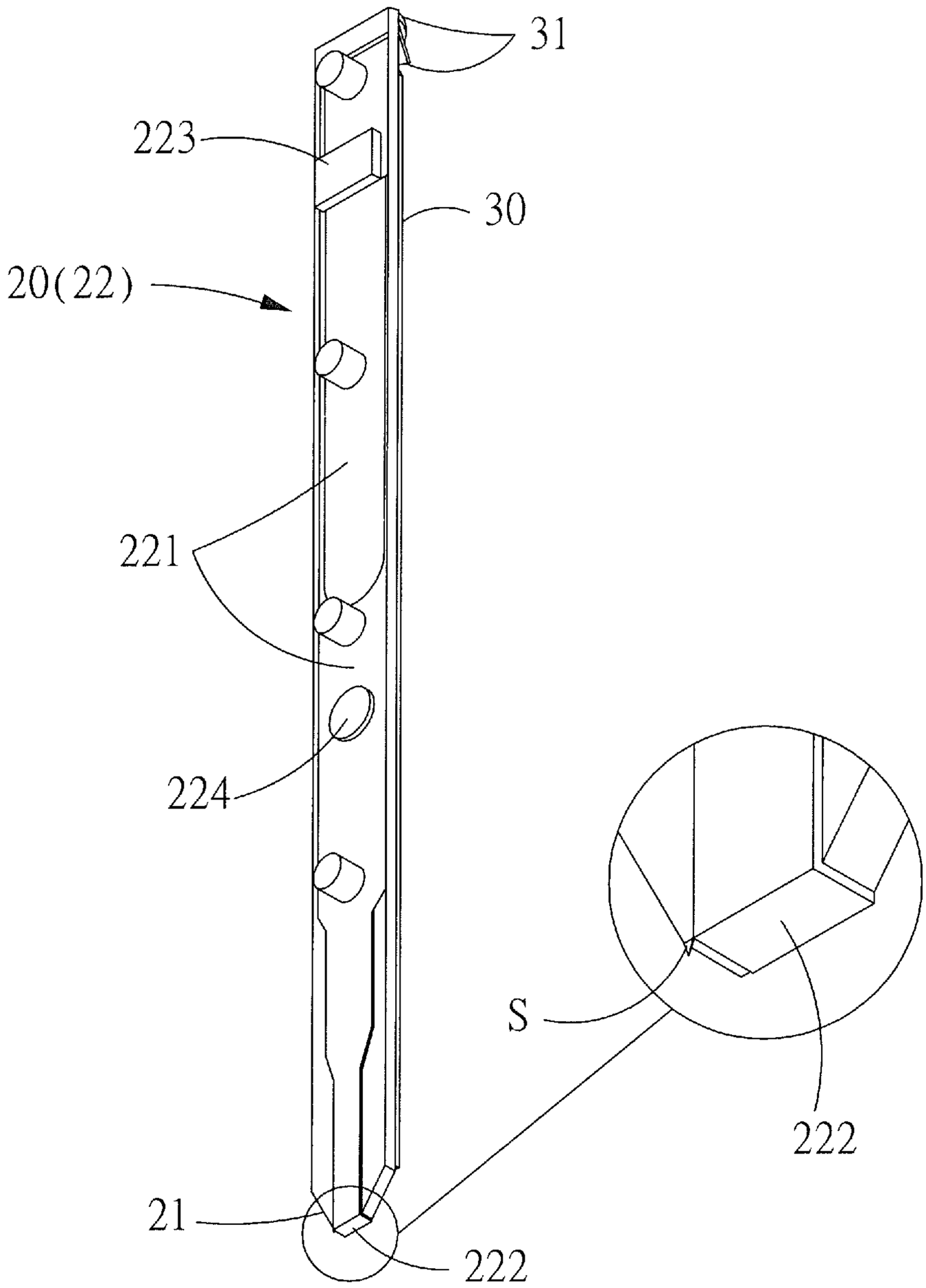


Fig.2

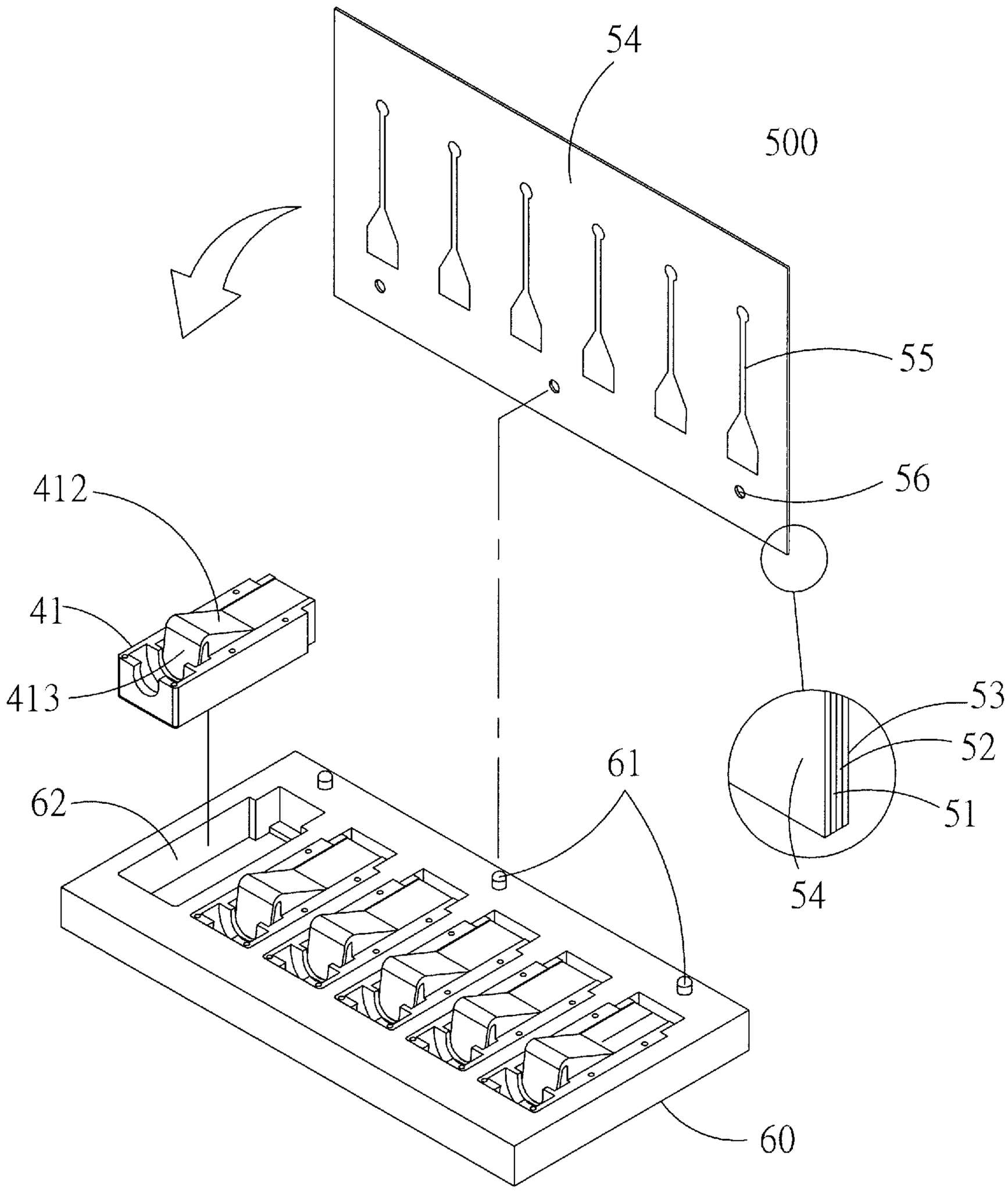
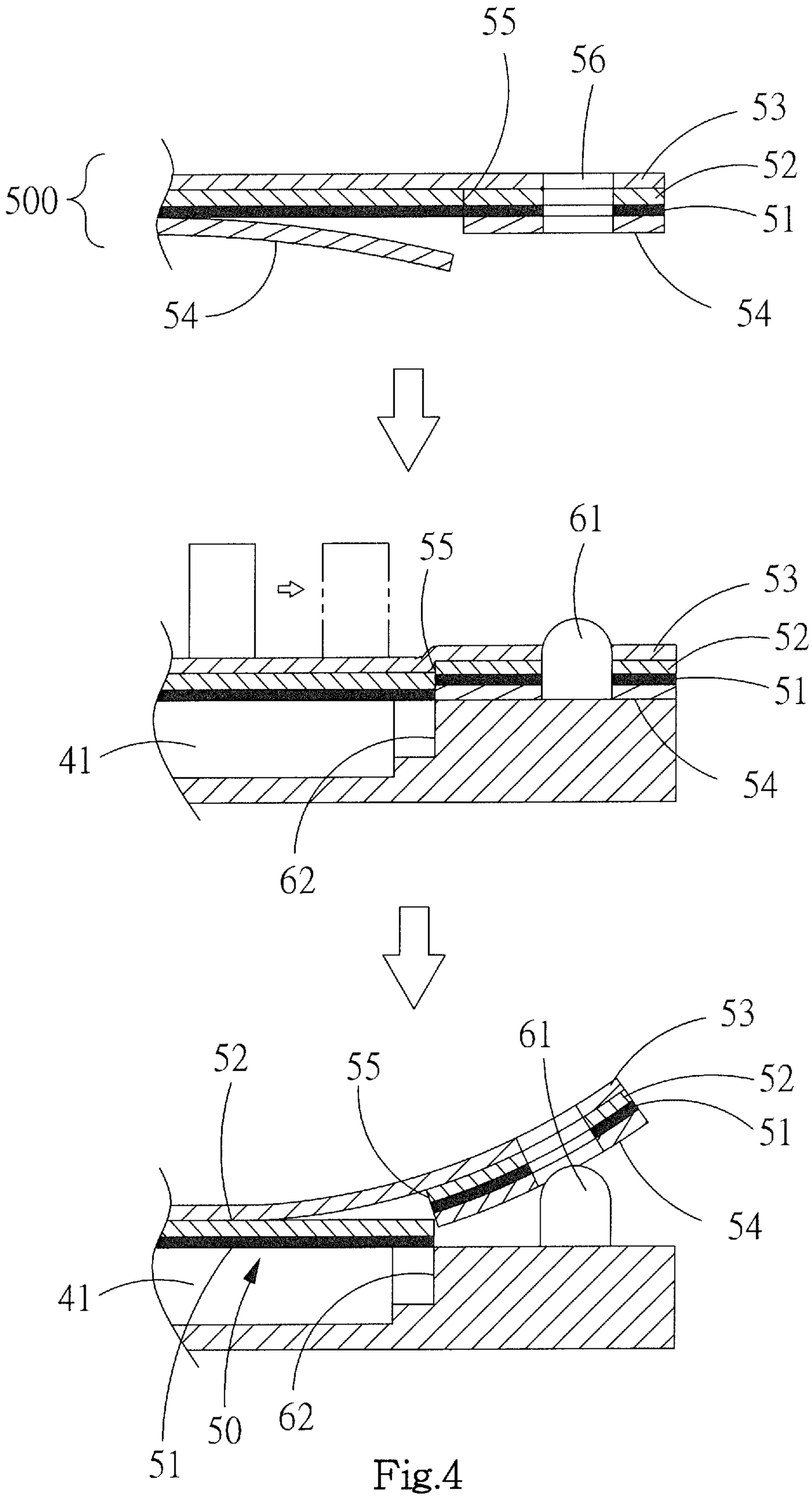


Fig.3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62

Fig.4

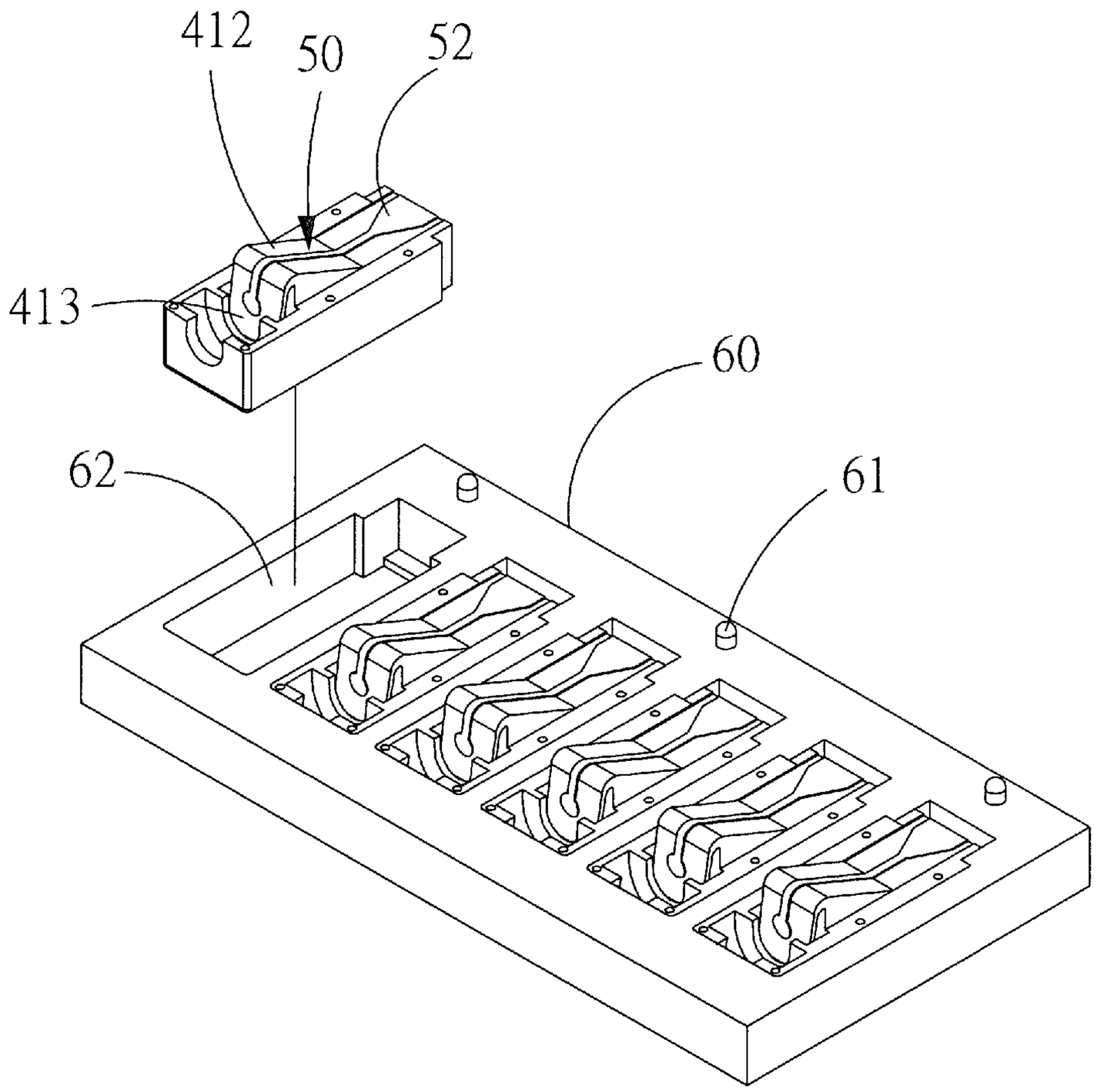


Fig.5

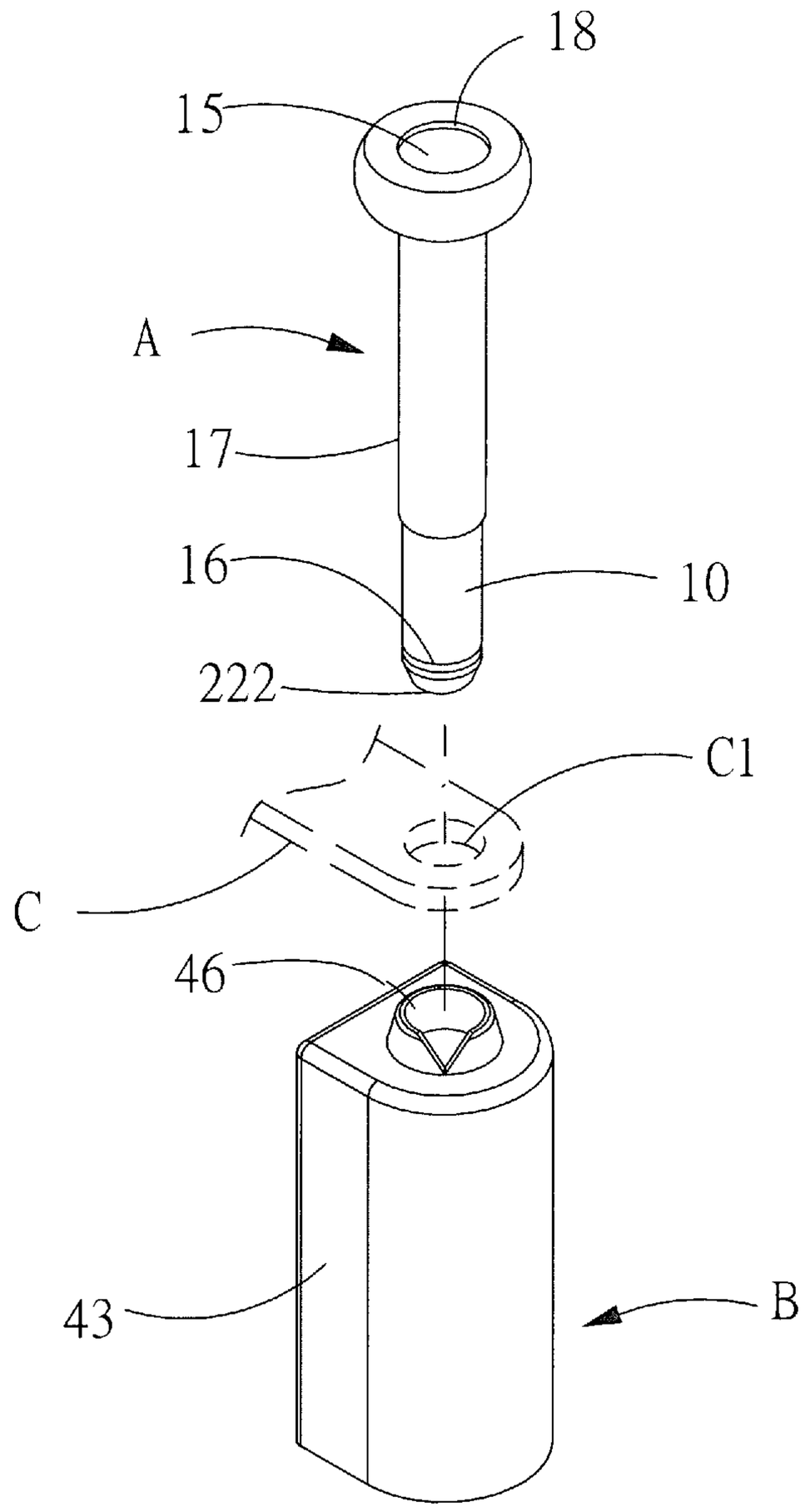
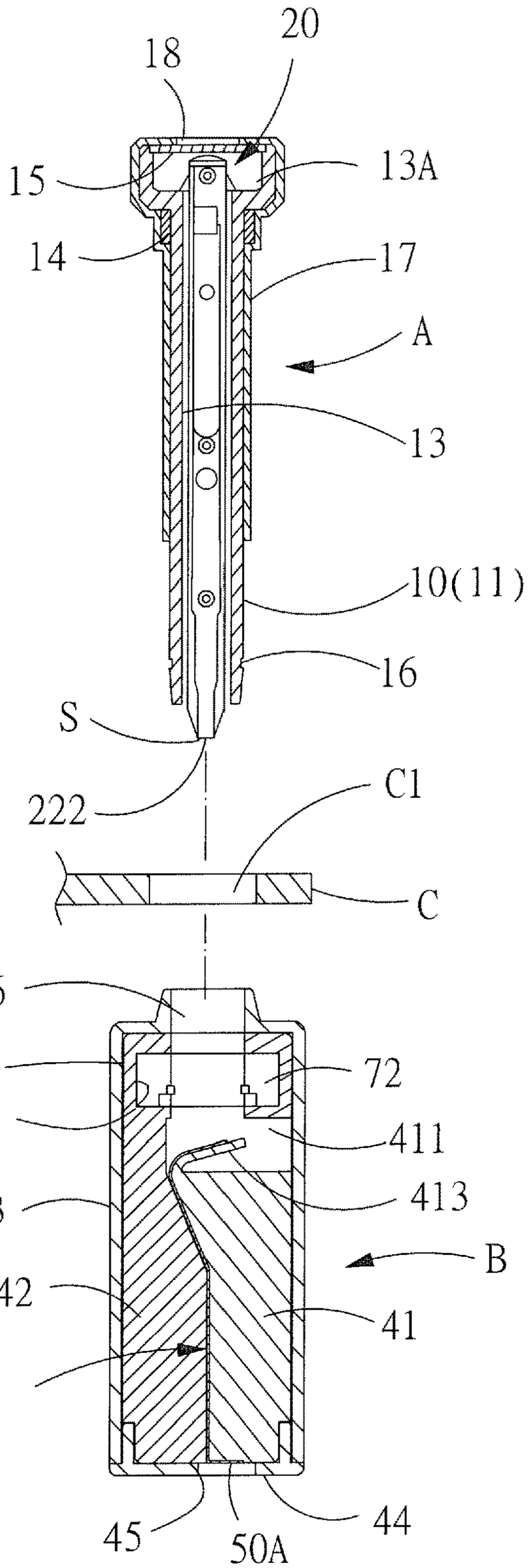


Fig.6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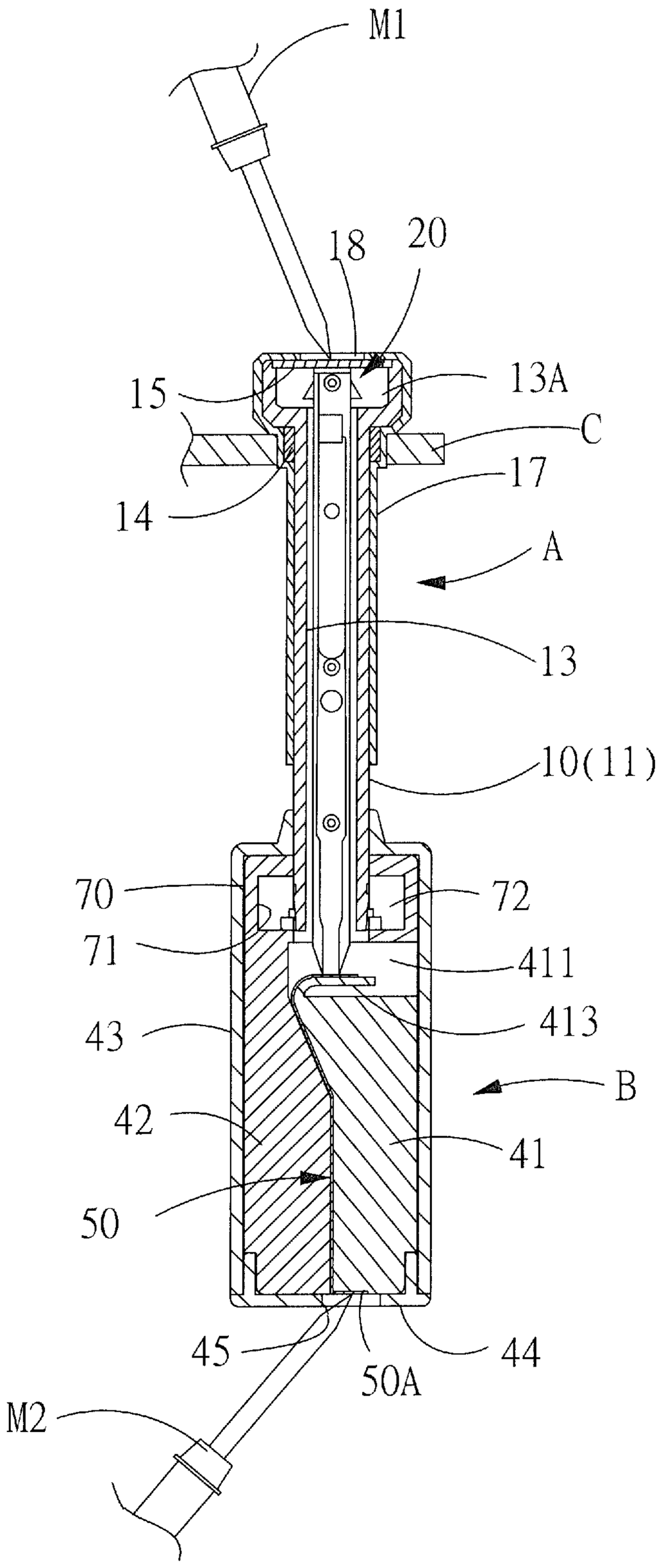
15
13A
14
17
A
13
10(11)
16
S
222
C1
C
46
70
72
71
411
43
413
B
42
41
50
45
50A
44

Fig.7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M2

Fig.8

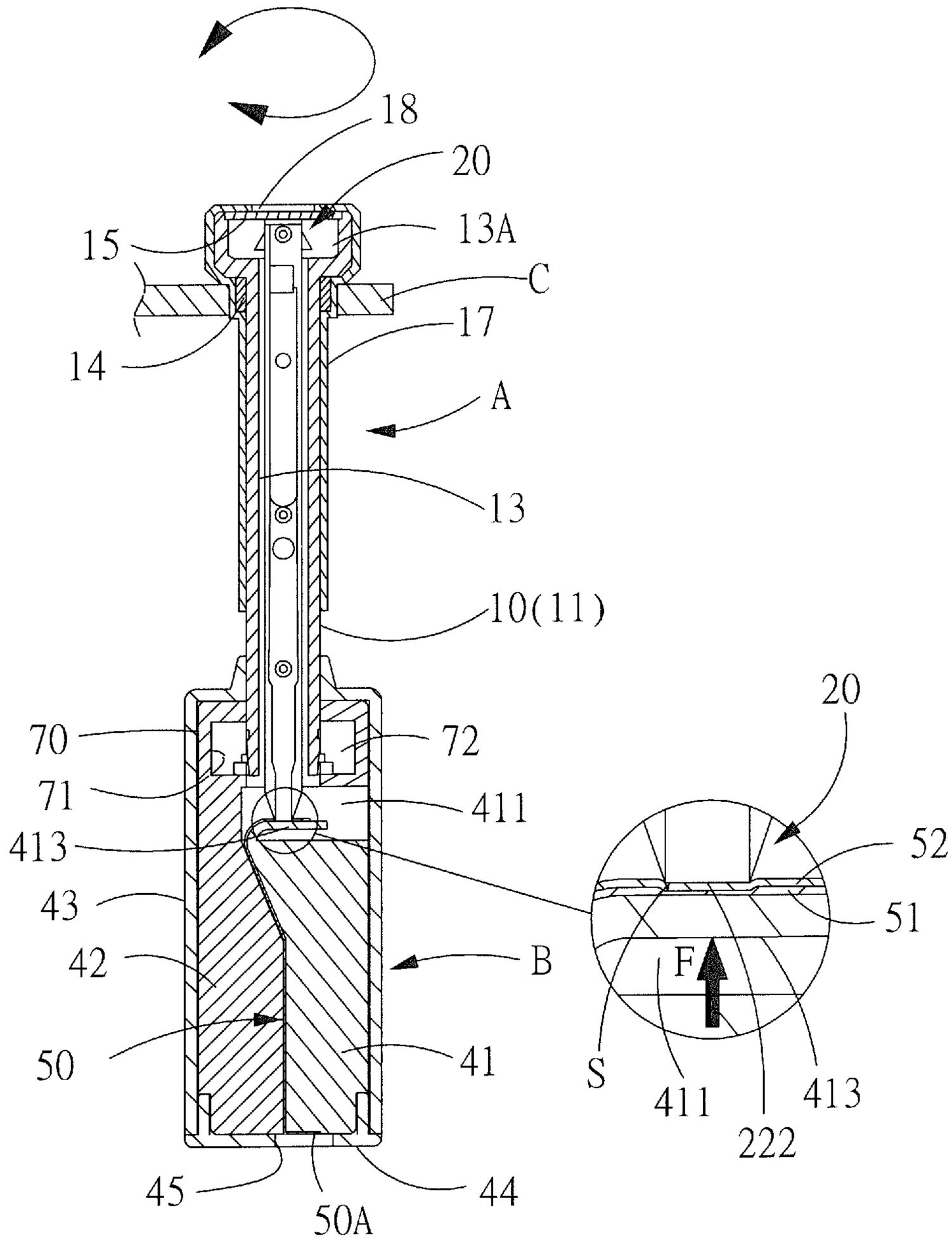
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Fig.9

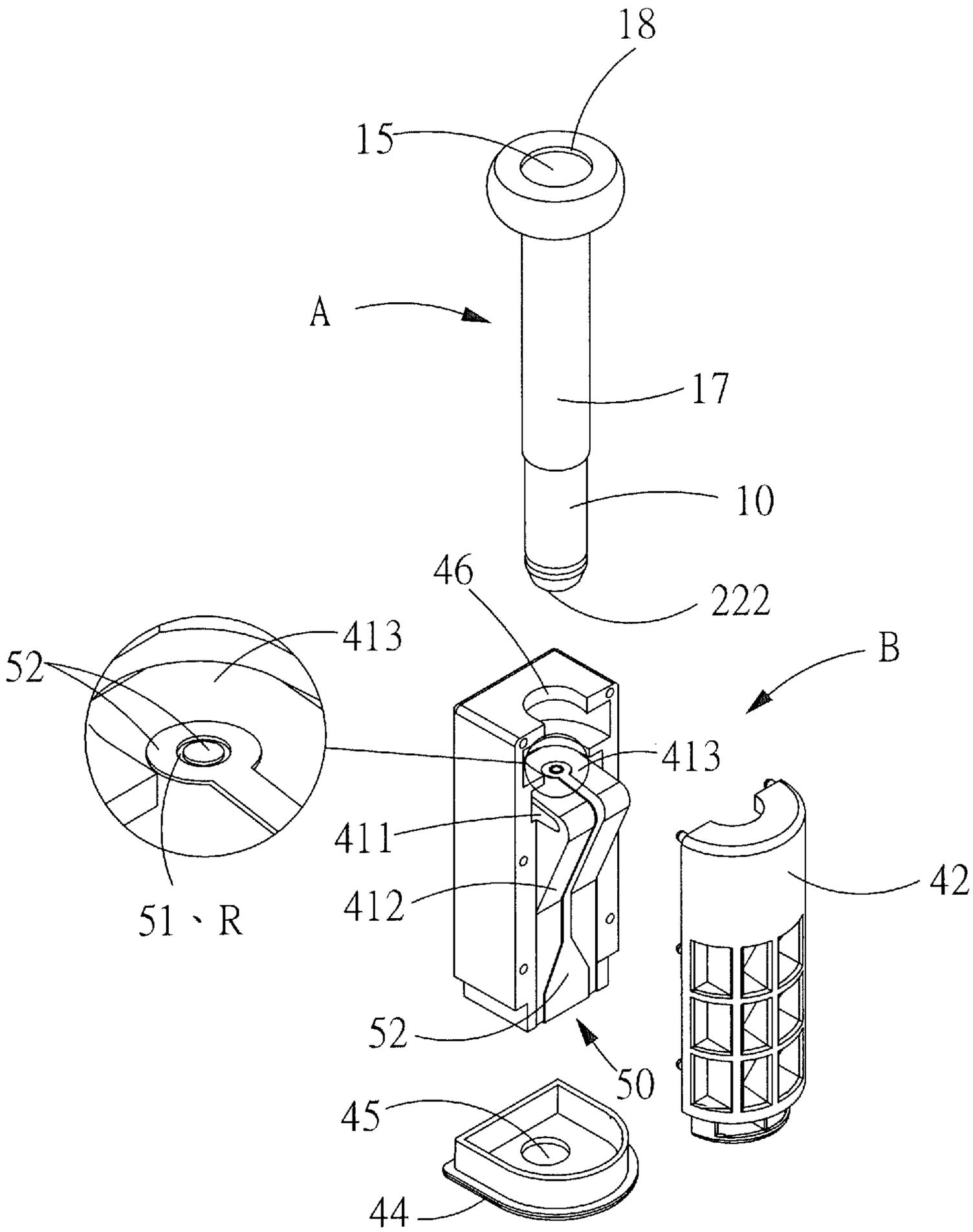

Fig.10

ANTI-THEFT ELECTRONIC SEAL

TECHNICAL FIELD OF THE INVENTION

The present invention relates to an anti-theft electronic seal capable of disconnecting an electric connection in advance before a burglar forces a bolt to rotate to destroy a first or second engagement portion.

DESCRIPTION OF THE PRIOR ART

One of the newest electronic seal technologies is for example U.S. Pat. No. 9,508,271 B2, titled "Electronic bolt seal", allowing an electric connection of the electronic bolt seal to be automatically disrupted so that a customers identification host can be warned through electromagnetic wave identification when a burglar grinds a bolt head of the casing. However, it poses the following shortcomings:

1. the first or second fastening elements will be destroyed, and the bolt and bolt seat are then separated when a burglar uses an electric tool (electric drill) to force the bolt to rotate continuously about the bolt seat; subsequently, the burglar can open the container door latch to conduct theft or replacement; thereafter, the burglar simply plugs the bolt back to the bolt seat, and buckles it back on the container door latch; whereby, the electronic seal is allowed to be operated normally as usual, causing the customer identification host to be unable to emit a warning; and
2. after an electronic seal is produced, quality control personnel need to feedback test through an identification host, but the identification host is not cheap and cannot be purchased in a larger number, causing the quality control efficiency not to be able to be increased.

SUMMARY OF THE INVENTION

The present invention is characterized in that the antenna is constituted by a glue layer of an elastic sheet and a metal layer covered on the glue layer, in combination with the bolt seat, the elastic sheet can provide a pre-pressure for the antenna when the bolt and bolt seat is positioned with the first, second engagement portions, allowing a lower contact of a circuit board and the metal layer to be powered on, and when the bolt is forced to rotate around an insertion hole, the circuit or lower contact is controlled to scratch the metal layer to form a short-circuit ring area, thereby interrupting the electric connection to allow the electronic seal to keep a warning function and the deficiencies of the above patent to be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded view of the present invention;

FIG. **2** is a schematically perspective view of a circuit board of the present invention;

FIGS. **3**, **4** and **5** respectively are a step of the process of the installment of an antenna on a bolt seat according to the present invention;

FIGS. **6** and **7** respectively show the relative positions of the bolt, a container door latch and the bolt seat;

FIG. **8** shows an instrument used to carry out a quality control test according to the present invention;

FIG. **9** is a cross-sectional view of the bolt in combination with the bolt seat according to the present invention' and

FIG. **10** shows a metal layer of the antenna is scratched by forcing the rotation of the bolt according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. **6** and **8**, an electronic seat of the present invention is constituted by a bolt A and bolt seat B, where the bolt A can be plugged into bolt seat B from top to bottom and thus locks a latch hole C**1** of a container door latch C, allowing a customers identification host to judge whether the container is opened normally.

Referring to FIGS. **1** to **8**, the bolt A is mainly constituted by a conductor **10**, circuit board **20** and insulating inner rod **30**, where the conductor **10** has a rod body **11**, cap head **12** radially expanded outward from the top end of the rod body **11**, accommodation hole **13** passed through the top face and bottom face of the rod body **11**, collar **14** pressed against the bottom end of the cap head **12**, where the diameter of the cap head **12** is large enough to allow it to be abutted against the door latch C. Furthermore, the top edge of the accommodation hole **13** further has a countersink **13**A with a larger diameter, and the top edge of the countersink **13**A is configured with a positioning hole **13**B with a much larger diameter allowing an electrically conductive upper cover **15** to seal; the lower outer peripheral of the conductor **10** is further encircled with a concave first engagement portion **16**, and the upper outer peripheral thereof is formed with an insulating sleeve **17** adapted to cover the collar **14** and upper cover **15**. In addition, a upper test area **8** maintaining exposing a part of the top face of the upper cover **13** is further recessed on the top end of the insulating sleeve **17**.

The circuit board **20** is hung inside the accommodation hole **13** through the insulating inner rod **30** fixed on the back face thereof, the bottom face of a necking **21** is allowed to be protruded out of the bottom end of the accommodation hole **13**, and a circuit wiring **221**, lower contact **222**, radio frequency identification (RFID) chip **223** and battery **224** are used to constitute a control circuit **22**, where the lower contact **222** is arranged on the rectangular bottom face of the necking **22**, allowing it to have a tendency to be protruded out of the bottom end of the accommodation hole **13**. Furthermore, the corner of the lower contact **222** of the bottom end of the circuit board **20** is further extended with a needle S, the bottom end of which is protruded downward out of the lower contact **222**. The inner rod **30** has an elastic portion **32** adapted to buckle the countersink **13**A and the bottom face of the upper cover **15**, thereby hanging the circuit board **20** elastically inside the accommodation hole **13**.

Referring to FIGS. **1** to **8** again, the bolt seat B is constituted by combining a first shell seat **41** with a second shell seat **12** face to face, and then inserting them into a hollow outer shell **43**, and sealing the bottom end of the outer shell **43** with a bottom cover **44**, through which a lower test area **45** adapted to power on the bottom end of the first shell seat **41** is further passed, and the upper part of the combined first and second shell seats **41**, **42** of the bolt seat B is formed into an insertion hole **46**, in which the lower part of the conductor **10** can be plugged. Furthermore, the first shell seat **41** further has a hollowed area **411** in communication with the bottom end of the insertion hole **46**, the bottom end of which is extended downward with a wedge-shaped bonding face **412**, the top end of which is further extended with an elastic sheet **412** inclined in the hollowed

area **411**, where an antenna **50** is allowed to be installed on the bonding face **412**, elastic sheet **413** and the bottom end of the first shell seat **41**.

The antenna **50** is at least constituted by a glue layer **51** and metal layer **52**, where the glue layer **51** is stuck on the bonding face **412**, elastic sheet **413** and the bottom end of the first shell seat **41**, and the metal layer **52** is covered on the glue layer **51**. Furthermore, the hardness of the lower contact **22** is further set to be larger than the one of the metal layer **52**. The antenna **50**, as FIGS. **3** to **5** show, is still made of a four-layer sticker **500** formed by stacking a light-transmissive layer **53**, metal layer **52**, glue layer **51** and separation layer **54** together in sequence. Thereafter, the back face of the separation layer **54** is cut into several contour lines **55** penetrated a depth up to the metal layer **52**, where the contour line **55** is shaped to match the antenna, and the sticker **500** is further passed through with alignment holes **56** on proper positions thereof, where the alignment hole **56** is matched with a corresponding alignment pin **61** of a jig **60**, and the jig **60** is further configured with mold holes **62** each corresponding to one of the contour lines **55**, where the mold hole **62** allows the first shell seat **41** to be positioned. First, the separation layer **54** inside the range of the each contour line **55** is torn off, and the alignment holes **56** are then caused to be in engagement with the corresponding alignment pins **61**. Next, the light transmissive layer **55** at the position where the separation layer **54** is torn off, and the metal layer **52**, glue layer **51** can then be transferred onto the bonding face **412** and elastic sheet **413**. Subsequently, the remnant of the sticker **500** is moved away and the first shell seats **41** are demolded. Finally, a fold edge **50**A of the antenna **50** is stuck to the bottom end of the first shell seat **41**, allowing the lower test area **45** to keep exposing a part of the fold edge **50**A of the antenna **50**, and the antenna **40** of each first shell seat **41** can thus be easily installed.

The bolt seat B is configured with a second engagement portion **70** extended radially outward with an annular groove **71** from the insertion hole **46**, where the annular groove **71** is installed with a buckle ring **72**, thereby allowing the first engagement portion **16** to be positioned by the buckle ring **72** after the bolt A is plugged in the latch hole C**1** and insertion hole **46** in sequence, and being used to lock the container door latch C. At this time, the elastic sheet **413** of the bolt seat B is allowed to provide a pre-pressure F so as to control the antenna **50** to be in contact with the lower contact **222**, and allow the needle S to be at least pierced through the metal layer **52** and overcome the elastic portion **31** to push the circuit board **20** to move upward, allowing the control circuit **22** to be in electric connection with the upper cover **15**, conductor **10** and antenna **50** (this technology has been disclosed in the patent mentioned above, such that the detail is omitted here) to allow the RFID chip **223** to emit the set identification electromagnetic wave so as to provide customers with an identification host automatic management. But, if a burglar cut the bolt A to steal or replace cargo inside a container, the circuit board **20** will form a short circuit to interrupt the electric connection, allowing the customers identification host to judge the container has been in an abnormal state.

Referring to FIG. **8**, when quality control personnel need to test whether the circuit board **20** inside the bolt A is in electric with the antenna **50** and conductor **10** through the bolt in combination with the bolt seat B after the products of the present invention is made, the upper test area **18** of the present invention allows the positive probe Ml of a multimeter to be in contact with the upper cover **15** and the lower test area **45** allows the negative prove the fold edge **50**A of the antenna **50** so that whether the electric connection is in a normal state can then be easily tested. Therefore, the upper test area **18** and lower test area **45** of the present invention allow a feedback test of an instrument such as a multimeter. Whereby, the instrument purchase cost of multimeters can be far lower than the one of current identification host such that they can be purchased in a large amount, allowing the quality control efficiency to be matched with the production efficiency.

Referring to FIGS. **9** and **10**, if a burglar uses a electric tool (such as an electric drill) to force the continuous rotation of the bolt A, and thereby to destroy the positioning of the first engagement portion **16** and second engagement portion **70** and further separate the bolt A from the bolt seat B to conduct theft or replacement. The needle S will be driven to scratch the metal layer **52** because the needle S has been pierced through the metal layer **53** at the time of forcing the continuous rotation of the bolt A, thereby forming a short-circuit ring area R, and thus interrupting the above electric connection so as to warn the identification host effectively. In addition, even if the present invention is arranged to have no needle S to pierce through the metal layer **52**, the corner of the lower contact **222** can still scratch the metal layer **52**, allowing the metal layer **52** to form the short-circuit ring area R under two important conditions of setting the hardness of the lower contact **22** to be larger the one of the metal layer **52** and controlling the pre-pressure F of the elastic sheet **413** to be large enough to allow the corner of the lower contact **222** to scratch the metal layer **52**.

I claim:

1. An anti-theft electronic seal, comprising:

a bolt, constituted by a conductor and circuit board, said conductor having an accommodation hole passed through a bottom face thereof, an outer peripheral of a upper part thereof covered with an insulating sleeve, a peripheral of a lower part of said conductor configured with a first engagement portion, said circuit board installed inside said accommodation hole, and a circuit wiring, radio frequency identification (RFID) chip and lower contact forming a control circuit, a bottom end of said lower contact allowed to protrude out of said accommodation hole; and

a bolt seat, an antenna and elastic sheet configured inside said bolt seat, said bolt seat having an insertion hole allowing the lower part of said conductor to be plugged therein and a second engagement portion for the positioning of said first engagement portion, said elastic sheet further controlled to provide a pre-pressure for said antenna and circuit board, allowing said antenna, control circuit and conductor to be in electric connection with one another, said electric connection disconnected when said electric connection is cut, said antenna constituted by glue layer in combination with said antenna and a metal layer in contact with said lower contact, and said circuit board or lower contact further driven to scratch said metal layer to form a short-circuit ring area when said bolt is forced to rotate around said insertion hole, thereby disconnecting said electric connection.

2. The electronic seal according to claim **1**, wherein hardness of said lower contact is larger than the one of said metal layer so as to make said pre-pressure allowance of said elastic sheet enough to allow a corner of said lower contact to scratch said metal layer to cause said metal to form said short-circuit ring area when said antenna, control circuit and conductor are in electric connection with one another and said bolt is forced to rotate continuously.

3. The electronic seal according to claim 2, wherein said bolt further defines a upper test area maintaining exposing a part of an outer peripheral of said conductor, and an outer peripheral of said bolt seat is recessed with a lower test area maintaining exposing a part of said antenna, allowing said upper test area and lower test area to be in contact with an instrument, and said instrument detects said electric connection when said antenna, control circuit and conductor are in the electric connection with one another.

4. The electronic sheet according to claim 3, wherein said accommodation hole is passed through a top face and bottom face of said conductor, a top edge of said accommodation hole has a countersink, a top edge of said countersink is configured with a positioning hole allowing an electrically conductive upper cover to be sealed, and said insulting sleeve is recessed with said upper test area maintaining exposing a part of a top face of said upper cover, said circuit board is further configured with an insulating inner rod having an elastic portion capable of buckling said countersink and a bottom face of said upper cover adapted to hang said circuit board in said accommodation hole; said bolt seat is formed by combining a first shell seat with a second shell seat face to face, then inserted in a hollow outer shell, and sealing a bottom end of said outer shell with a bottom cover; said bottom cover is further passed through with a lower test area in communication with a bottom end of said first shell seat, a upper part of said first shell seat and second shell seat combined with each other face to face has the insertion hole allowing the lower part of said conductor to be plugged therein, said first shell seat further has a hollowed area in communication with a bottom end of said insertion hole, a bottom end of said hollowed are is extended downward with a bonding face, a top end of said bonding face is configured with an elastic sheet, said bonding face, elastic sheet allow said antenna to be installed thereon, said antenna is installed on a bottom end of said first shell seat with a fold edge thereof, and said lower test area maintains exposing a part of said fold edge.

5. A method for making an anti-theft electronic seal, comprising the following steps:

providing said bolt and bolt seat according to claim 2;

allowing an antenna to be made of a four-layer sticker formed by a light-transmissive layer, metal layer, glue layer and separation layer stacked in sequence from top to bottom;

cutting a number of contour lines having a depth through said metal layer on a back face of said separation layer, said contour line corresponding to an antenna in shape:

tearing down said separation layer in a range of each contour line; and

pressing said light-transmissive layer in a range of each contour line downward, thereby transferring said metal layer and glue layer onto said bolt seat in order to complete the installment of said antenna.

6. The method according to claim 5, wherein a sticker is further configured with through positioning holes matched with corresponding positioning pins of a jig, and said jig is further configured with mold holes each corresponding to one of said contour lines and adapted to provide the positioning of said bolt seat for the installment of said antenna.

7. The electronic seal according to claim 1, wherein a bottom end of said circuit board is further extended with a needle, a bottom end of said needle is protruded downward out of said lower contact so as to allow said needle to be able to be pierced through said metal layer when said antenna, control circuit and conductor is in the electric connection with one another, and said needle is driven to scratch said metal layer to form said short-circuit ring area when said bolt is forced to rotate continuously.

8. The electronic seal according to claim 7, wherein said bolt further defines a upper test area maintaining exposing a part of an outer peripheral of said conductor, and an outer peripheral of said bolt seat is recessed with a lower test area maintaining exposing a part of said antenna, allowing said upper test area and lower test area to be in contact with an instrument, and said instrument detects said electric connection when said antenna, control circuit and conductor are in the electric connection with one another.

9. The electronic sheet according to claim 8, wherein said accommodation hole is passed through a top face and bottom face of said conductor, a top edge of said accommodation hole has a countersink, a top edge of said countersink is configured with a positioning hole allowing an electrically conductive upper cover to be sealed, and said insulting sleeve is recessed with said upper test area maintaining exposing a part of a top face of said upper cover, said circuit board is further configured with an insulating inner rod having an elastic portion capable of buckling said countersink and a bottom face of said upper cover adapted to hang said circuit board in said accommodation hole; said bolt seat is formed by combining a first shell seat with a second shell seat face to face, then inserted in a hollow outer shell, and sealing a bottom end of said outer shell with a bottom cover; said bottom cover is further passed through with a lower test area in communication with a bottom end of said first shell seat, a upper part of said first shell seat and second shell seat combined with each other face to face has the insertion hole allowing the lower part of said conductor to be plugged therein, said first shell seat further has a hollowed area in communication with a bottom end of said insertion hole, a bottom end of said hollowed are is extended downward with a bonding face, a top end of said bonding face is configured with an elastic sheet, said bonding face, elastic sheet allow said antenna to be installed thereon, said antenna is installed on a bottom end of said first shell seat with a fold edge thereof, and said lower test area maintains exposing a part of said fold edge.

10. The electronic seal according to claim 1, wherein said bolt further defines a upper test area maintaining exposing a part of an outer peripheral of said conductor, and an outer peripheral of said bolt seat is recessed with a lower test area maintaining exposing a part of said antenna, allowing said upper test area and lower test area to be in contact with an instrument, and said instrument detects said electric connection when said antenna, control circuit and conductor are in the electric connection with one another.

11. The electronic sheet according to claim 10, wherein said accommodation hole is passed through a top face and bottom face of said conductor, a top edge of said accommodation hole has a countersink, a top edge of said countersink is configured with a positioning hole allowing an electrically conductive upper cover to be sealed, and said insulting sleeve is recessed with said upper test area maintaining exposing a part of a top face of said upper cover, said circuit board is further configured with an insulating inner rod having an elastic portion capable of buckling said countersink and a bottom face of said upper cover adapted to hang said circuit board in said accommodation hole; said bolt seat is formed by combining a first shell seat with a second shell seat face to face, then inserted in a hollow outer shell, and sealing a bottom end of said outer shell with a bottom cover; said bottom cover is further passed through with a lower test area in communication with a bottom end of said first shell seat, an upper part of said first shell seat and

second shell seat combined with each other face to face has the insertion hole allowing the lower part of said conductor to be plugged therein, said first shell seat further has a hollowed area in communication with a bottom end of said insertion hole, a bottom end of said hollowed are is extended downward with a bonding face, a top end of said bonding face is configured with an elastic sheet, said bonding face, elastic sheet allow said antenna to be installed thereon, said antenna is installed on a bottom end of said first shell seat with a fold edge thereof, and said lower test area maintains exposing a part of said fold edge.

12. A method for making an anti-theft electronic seal, comprising the following steps:

providing said bolt and bolt seat according to claim **1**;

allowing an antenna to be made of a four-layer sticker formed by a light-transmissive layer, metal layer, glue layer and separation layer stacked in sequence from top to bottom;

cutting a number of contour lines having a depth through said metal layer on a back face of said separation layer, said contour lines corresponding to said antenna in shape:

tearing down said separation layer in a range of each contour line; and

pressing said light-transmissive layer in a range of each contour line downward, thereby transferring said metal layer and glue layer onto said bolt seat in order to complete the installment of said antenna.

13. The method according to claim **12**, wherein said sticker is further configured with through positioning holes matched with corresponding positioning pins of a jig, and said jig is further configured with mold holes each corresponding to one of said contour lines and adapted to provide the positioning of said bolt seat for the installment of said antenna.

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